US007467400B1

(12) **United States Patent**
Moss et al.

(10) **Patent No.: US 7,467,400 B1**
(45) **Date of Patent: Dec. 16, 2008**

(54) **INTEGRATED SECURITY SYSTEM HAVING NETWORK ENABLED ACCESS CONTROL AND INTERFACE DEVICES**

(75) Inventors: **John L. Moss**, Wayland, MA (US); **Barry Gaiman**, Belmont, MA (US)

(73) Assignee: **S2 Security Corporation**, Framingham, MA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 975 days.

(21) Appl. No.: **10/779,928**

(22) Filed: **Feb. 17, 2004**

Related U.S. Application Data

(60) Provisional application No. 60/447,544, filed on Feb. 14, 2003.

(51) **Int. Cl.**
G06F 17/30 (2006.01)
G06F 15/18 (2006.01)
H04L 9/00 (2006.01)

(52) **U.S. Cl.** **726/3**; 726/22; 726/23; 713/150

(58) **Field of Classification Search** 726/3
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,839,640	A	6/1989	Ozer et al.
5,210,873	A	5/1993	Gay et al.
6,119,125	A	9/2000	Gloudeman et al.
6,157,943	A	12/2000	Meyer
6,233,588	B1	5/2001	Marchoili et al.
6,271,752	B1	8/2001	Vaios
6,374,356	B1	4/2002	Daigneault et al.
6,422,463	B1	7/2002	Flink

(Continued)

FOREIGN PATENT DOCUMENTS

WO WO 2004055608 A2 * 7/2004

OTHER PUBLICATIONS

Vutukuru et al, Efficient and Robust TCP Stream Normalization, 2008, IEEE, pp. 96-110.*

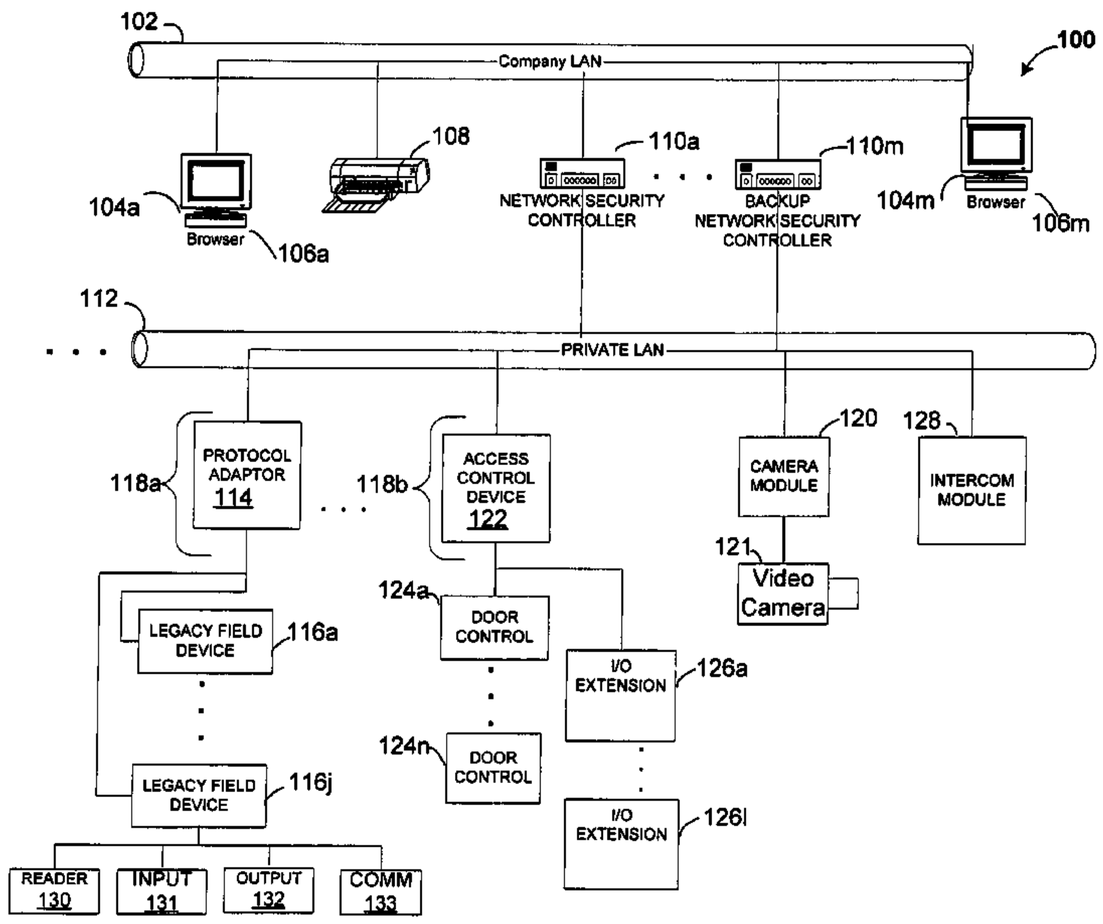
(Continued)

Primary Examiner—Ayaz R Sheikh
Assistant Examiner—Aravind K Moorthy
(74) *Attorney, Agent, or Firm*—Chapin IP Law, LLC; Barry Gaiman, Esq.

(57) **ABSTRACT**

An integrated security system operating over a network includes a network security controller coupled to the network having a relational database including portal objects and related resources represented in at least one table in the relational database. The system further includes at least one network node having a local database coupled to the network adapted to receive predetermined resource information from the relational database, an event generator coupled to the local database to provide at least one portal event in response to the predetermined resource information received by the local database, and a finite state portal controller coupled to the network and the event generator for providing at least one of an action and a global event in response to the at least one portal event.

9 Claims, 8 Drawing Sheets



U.S. PATENT DOCUMENTS

6,504,479	B1	1/2003	Lemons et al.	
6,643,779	B1	11/2003	Leung et al.	
6,990,660	B2 *	1/2006	Moshir et al.	717/171
2001/0034754	A1 *	10/2001	Elwahab et al.	709/201
2003/0080865	A1	5/2003	Capowski et al.	
2003/0210139	A1 *	11/2003	Brooks et al.	340/531
2007/0180107	A1 *	8/2007	Newton et al.	709/224
2007/0204338	A1 *	8/2007	Aiello et al.	726/11
2007/0214504	A1 *	9/2007	Milani Comparetti	726/23

OTHER PUBLICATIONS

Wang et al, Shield: Vulnerability-Driven Network Filters for Preventing Known Vulnerability Exploits, 2004, ACM, pp. 193-204.*

Watson et al, Protocol Scrubbing: Network Security Through Transparent Flow Modification, 2001, ACM, pp. 261-273.*

Rubin et al, Protomatching Network Traffic for High Throughput Network Intrusion Detection, 2006, ACM, pp. 47-58.*

* cited by examiner

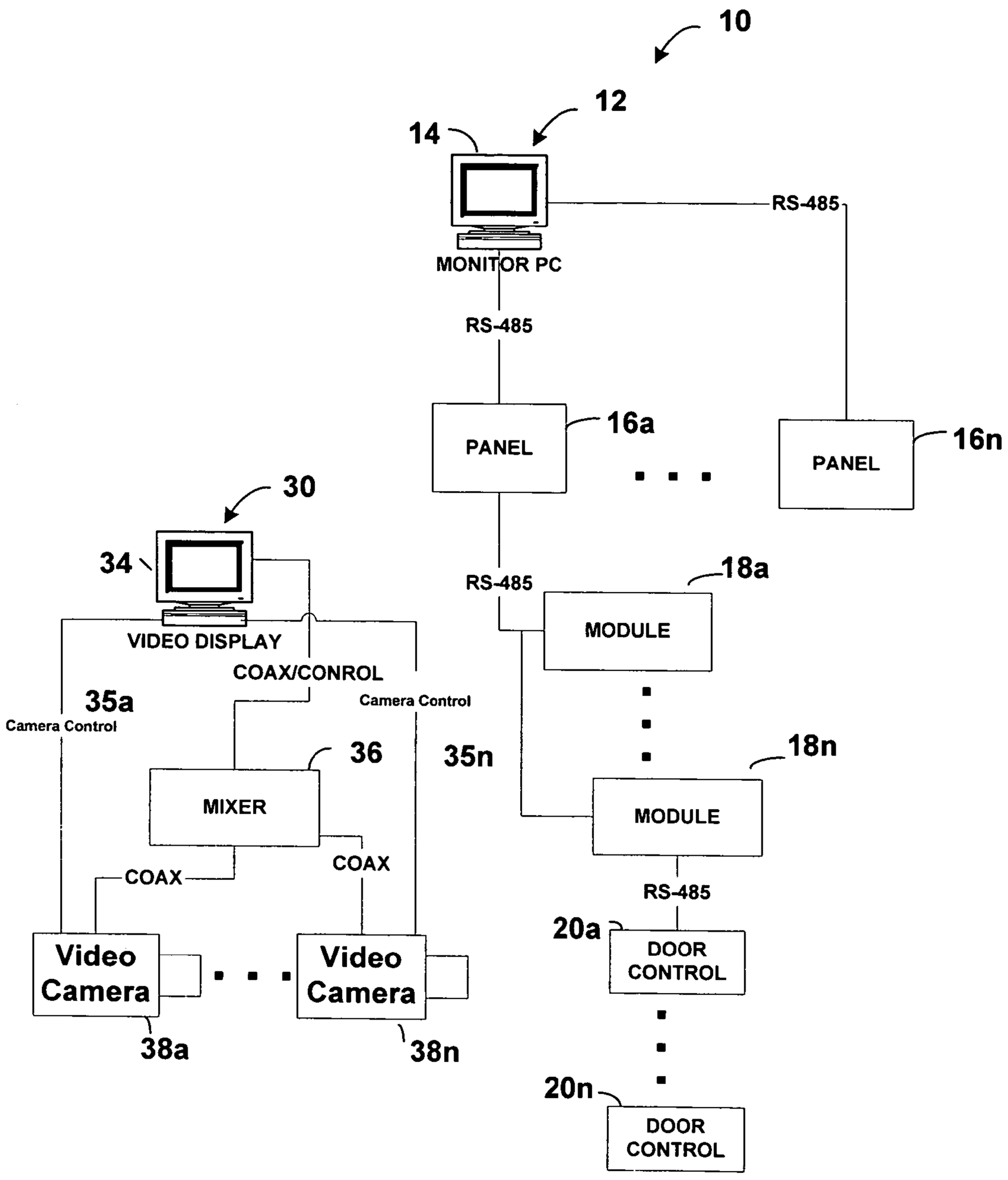


FIG. 1(PRIOR ART)

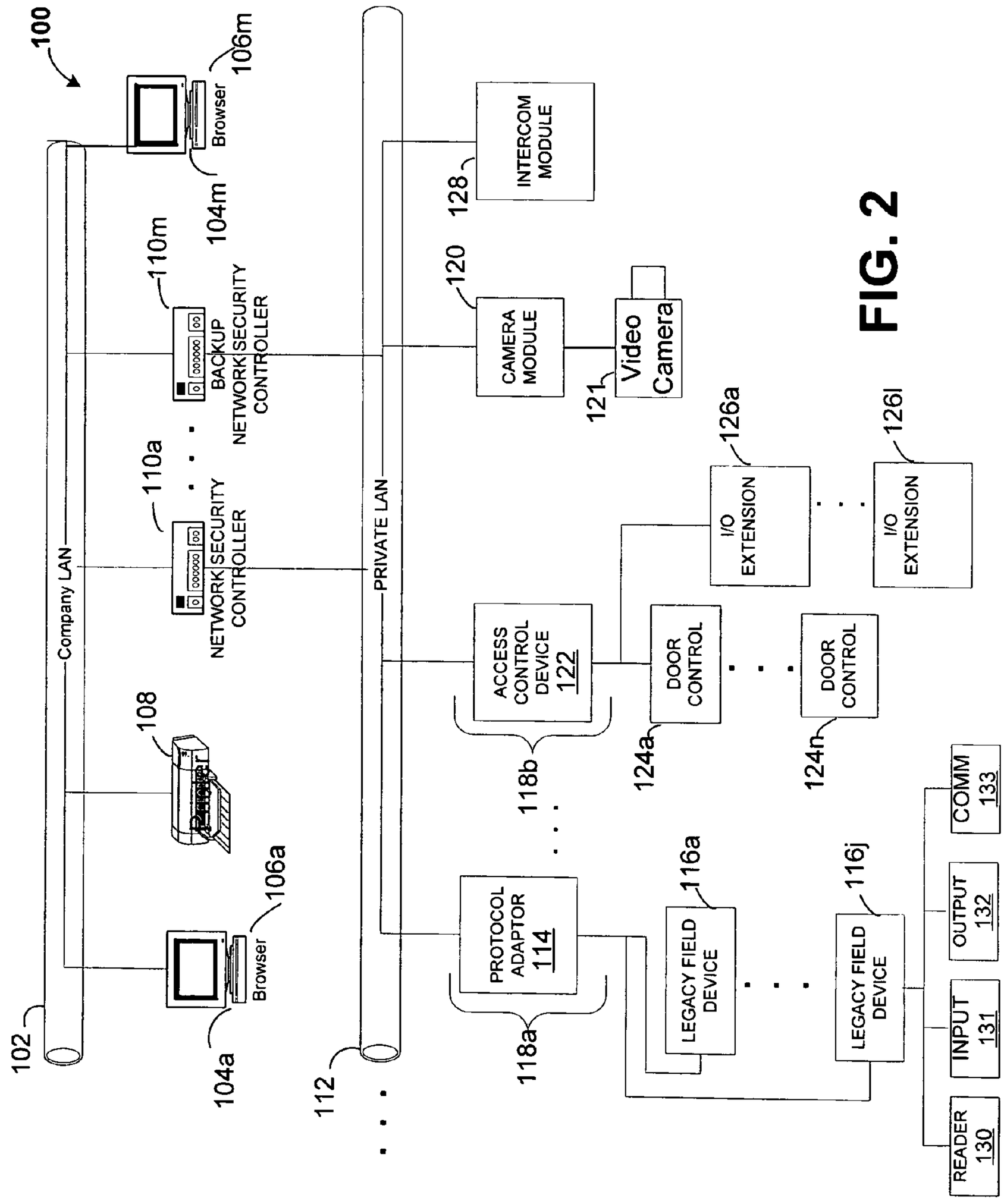

100
106m
Browser
104m
110m
BACKUP NETWORK SECURITY CONTROLLER
110a
NETWORK SECURITY CONTROLLER
Company LAN
PRIVATE LAN
108
Printer
106a
Browser
104a
102
112
128
INTERCOM MODULE
120
CAMERA MODULE
121
Video Camera
ACCESS CONTROL DEVICE 122
118b
118a
PROTOCOL ADAPTOR 114
124a
DOOR CONTROL
124n
DOOR CONTROL
126a
I/O EXTENSION
126l
I/O EXTENSION
116a
116j
LEGACY FIELD DEVICE
LEGACY FIELD DEVICE
COMM 133
OUTPUT 132
INPUT 131
READER 130

FIG. 2

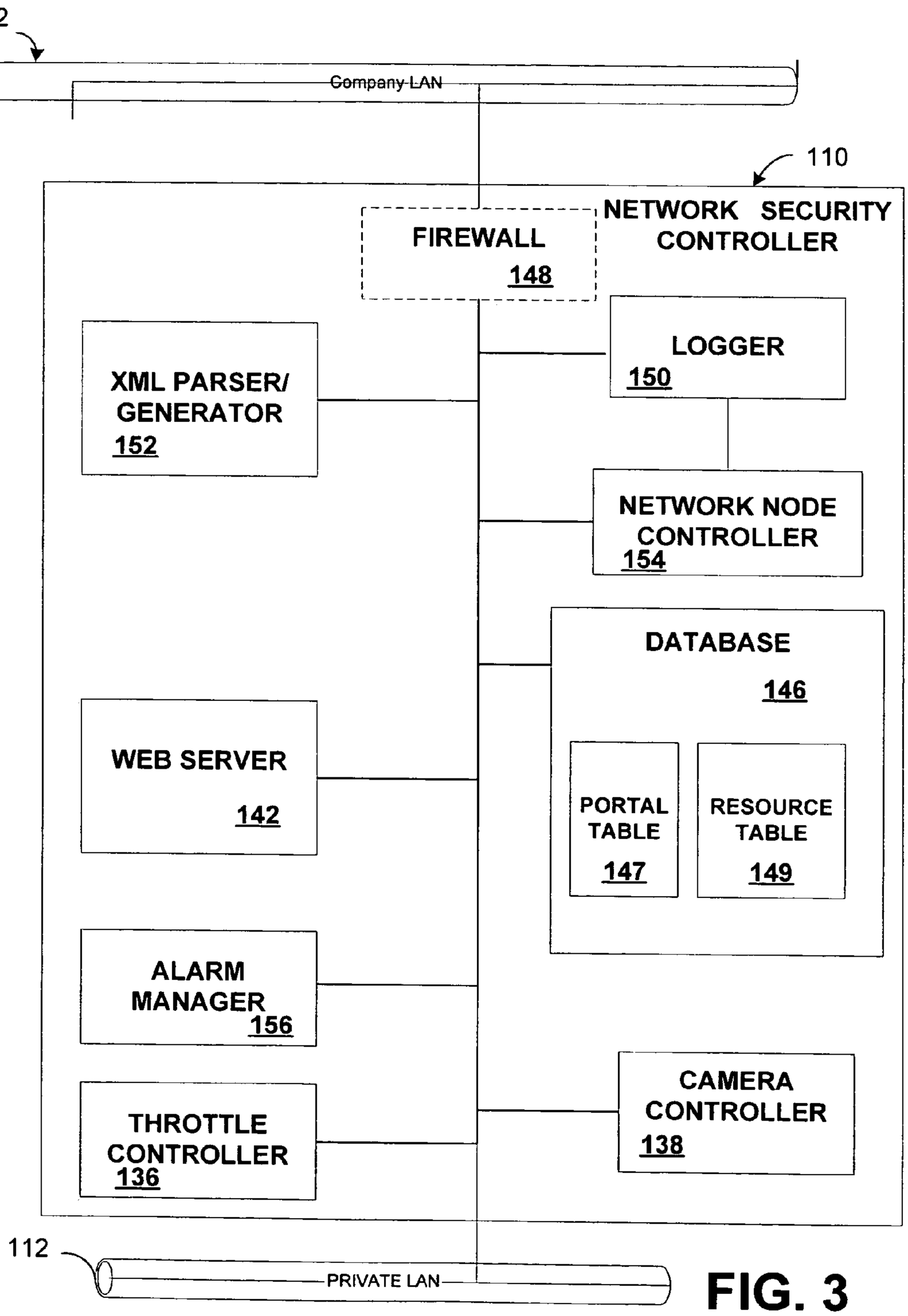

102
Company LAN
110
NETWORK SECURITY CONTROLLER
FIREWALL
148
LOGGER
150
XML PARSER/ GENERATOR
152
NETWORK NODE CONTROLLER
154
DATABASE
146
PORTAL TABLE
147
RESOURCE TABLE
149
WEB SERVER
142
ALARM MANAGER
156
THROTTLE CONTROLLER
136
CAMERA CONTROLLER
138
112
PRIVATE LAN

FIG. 3

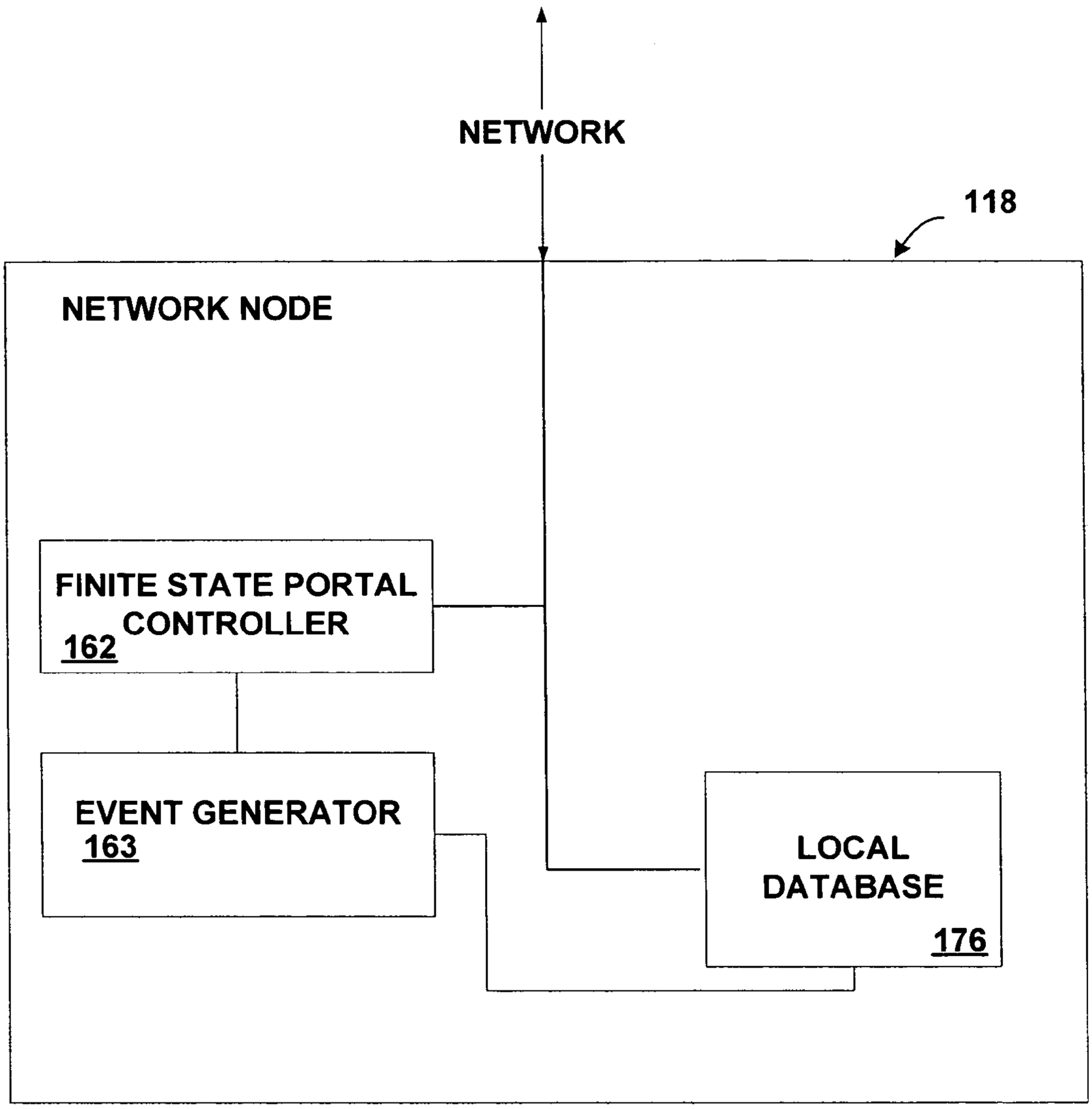

NETWORK
118
NETWORK NODE
FINITE STATE PORTAL CONTROLLER
162
EVENT GENERATOR
163
LOCAL DATABASE
176

FIG. 4

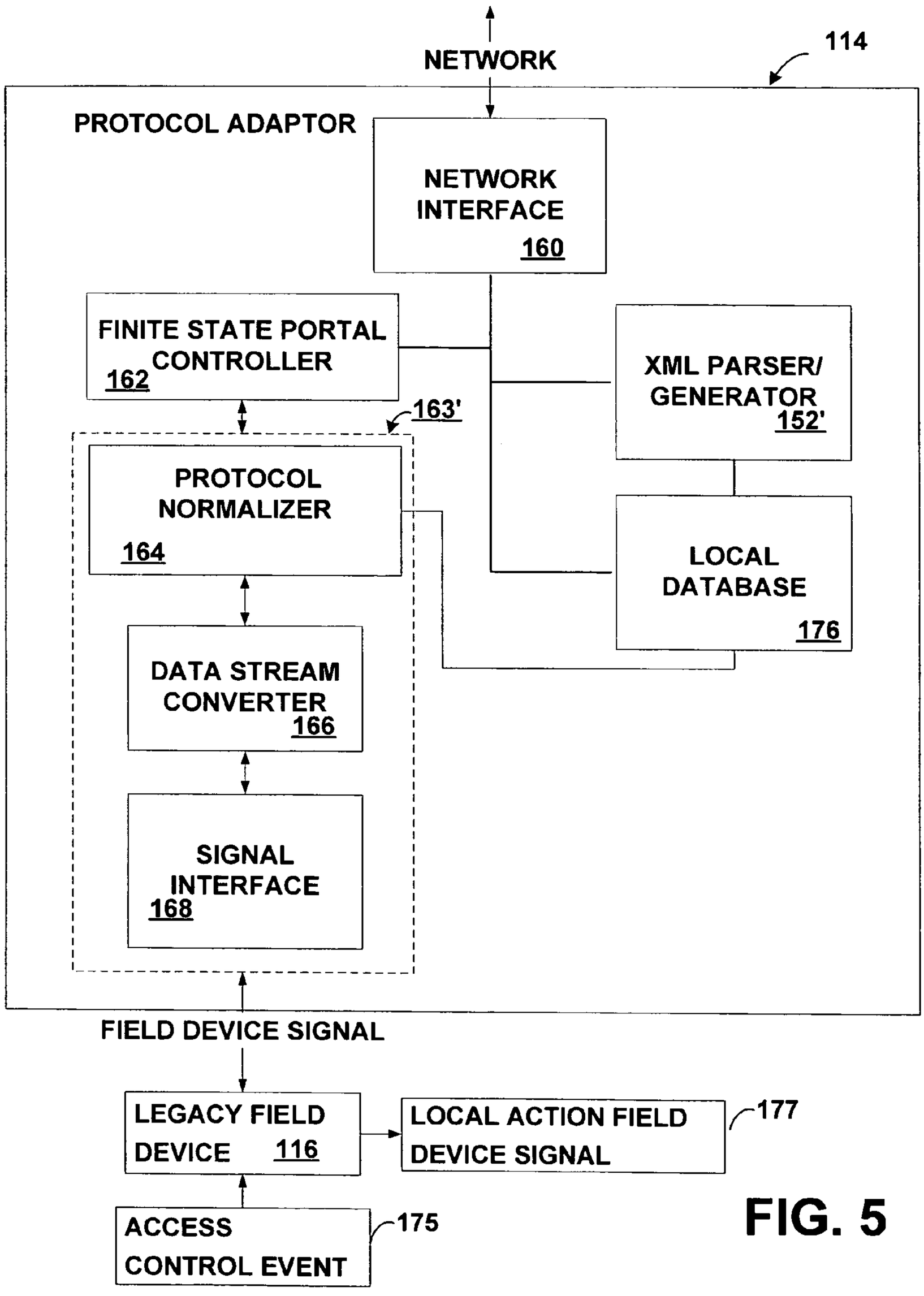

NETWORK
114
PROTOCOL ADAPTOR
NETWORK INTERFACE
160
FINITE STATE PORTAL CONTROLLER
162
XML PARSER/ GENERATOR
152'
163'
PROTOCOL NORMALIZER
164
LOCAL DATABASE
176
DATA STREAM CONVERTER
166
SIGNAL INTERFACE
168
FIELD DEVICE SIGNAL
LEGACY FIELD DEVICE 116
LOCAL ACTION FIELD DEVICE SIGNAL
177
ACCESS CONTROL EVENT
175

FIG. 5

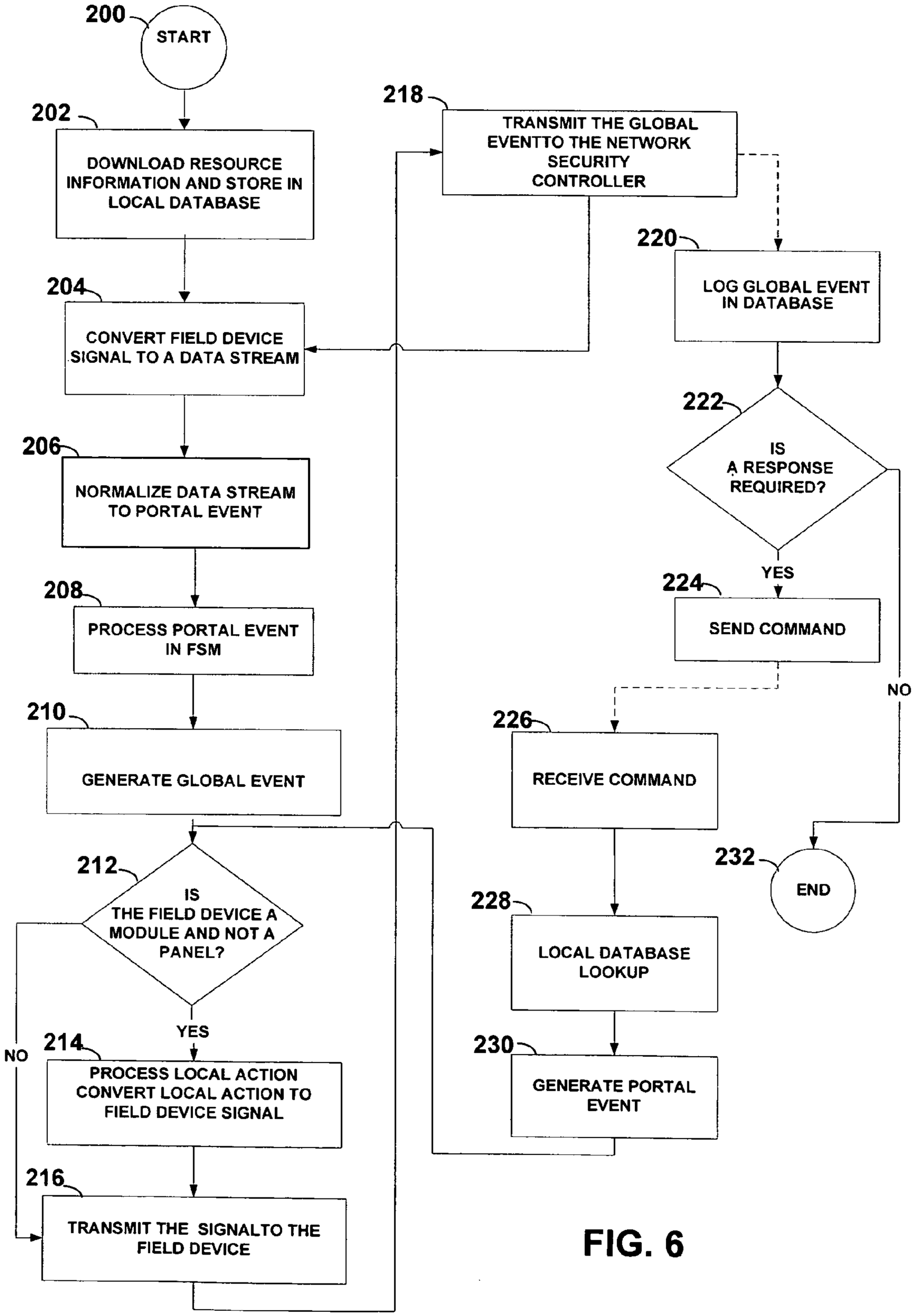

200
START
202
DOWNLOAD RESOURCE INFORMATION AND STORE IN LOCAL DATABASE
204
CONVERT FIELD DEVICE SIGNAL TO A DATA STREAM
206
NORMALIZE DATA STREAM TO PORTAL EVENT
208
PROCESS PORTAL EVENT IN FSM
210
GENERATE GLOBAL EVENT
212
IS THE FIELD DEVICE A MODULE AND NOT A PANEL?
YES
NO
214
PROCESS LOCAL ACTION CONVERT LOCAL ACTION TO FIELD DEVICE SIGNAL
216
TRANSMIT THE SIGNALTO THE FIELD DEVICE
218
TRANSMIT THE GLOBAL EVENTTO THE NETWORK SECURITY CONTROLLER
220
LOG GLOBAL EVENT IN DATABASE
222
IS A RESPONSE REQUIRED?
YES
NO
224
SEND COMMAND
226
RECEIVE COMMAND
228
LOCAL DATABASE LOOKUP
230
GENERATE PORTAL EVENT
232
END

FIG. 6

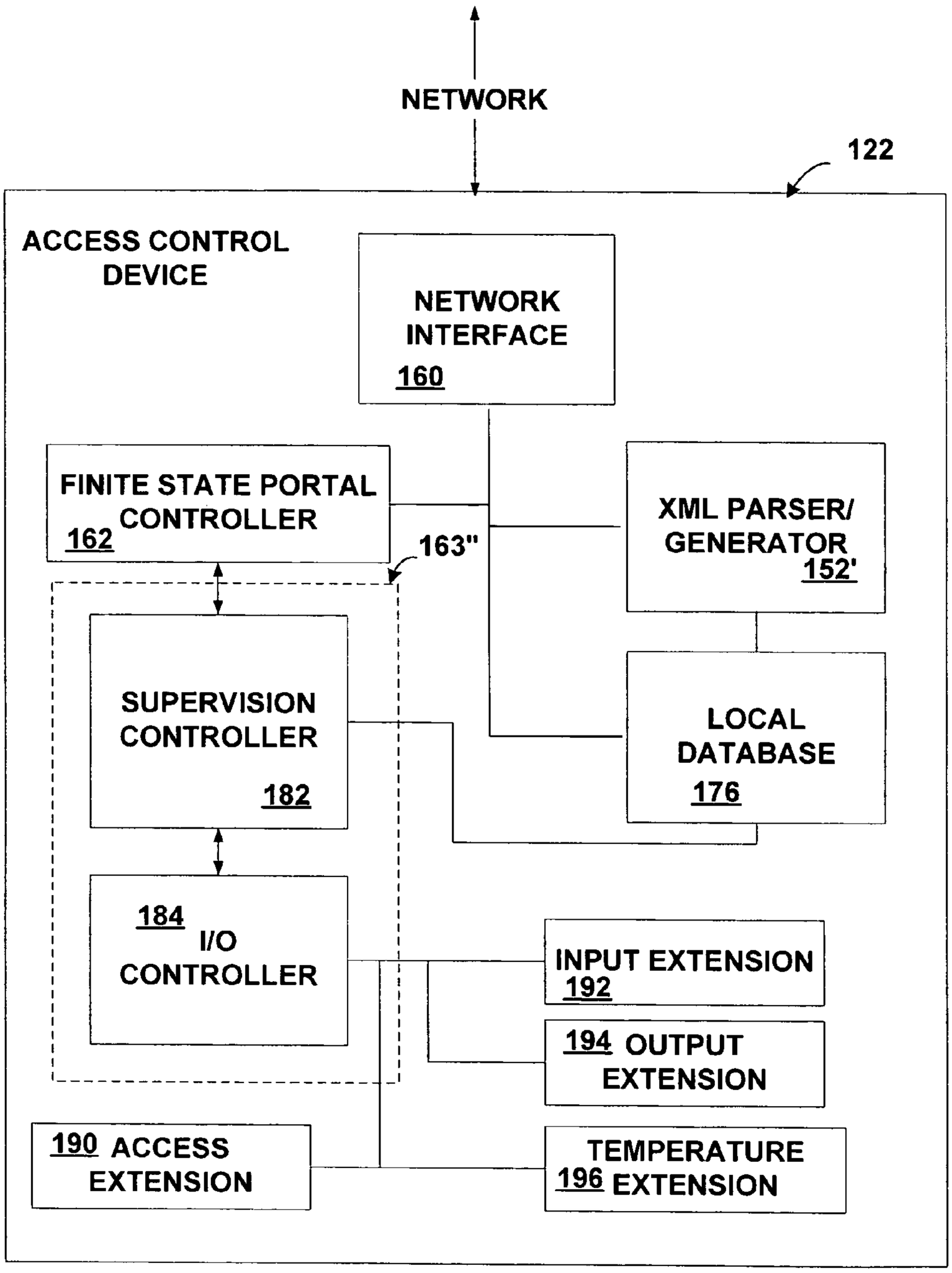

NETWORK
122
ACCESS CONTROL DEVICE
NETWORK INTERFACE
160
FINITE STATE PORTAL CONTROLLER
162
163"
XML PARSER/ GENERATOR
152'
SUPERVISION CONTROLLER
182
LOCAL DATABASE
176
184 I/O CONTROLLER
INPUT EXTENSION
192
194 OUTPUT EXTENSION
190 ACCESS EXTENSION
TEMPERATURE
196 EXTENSION

FIG. 7

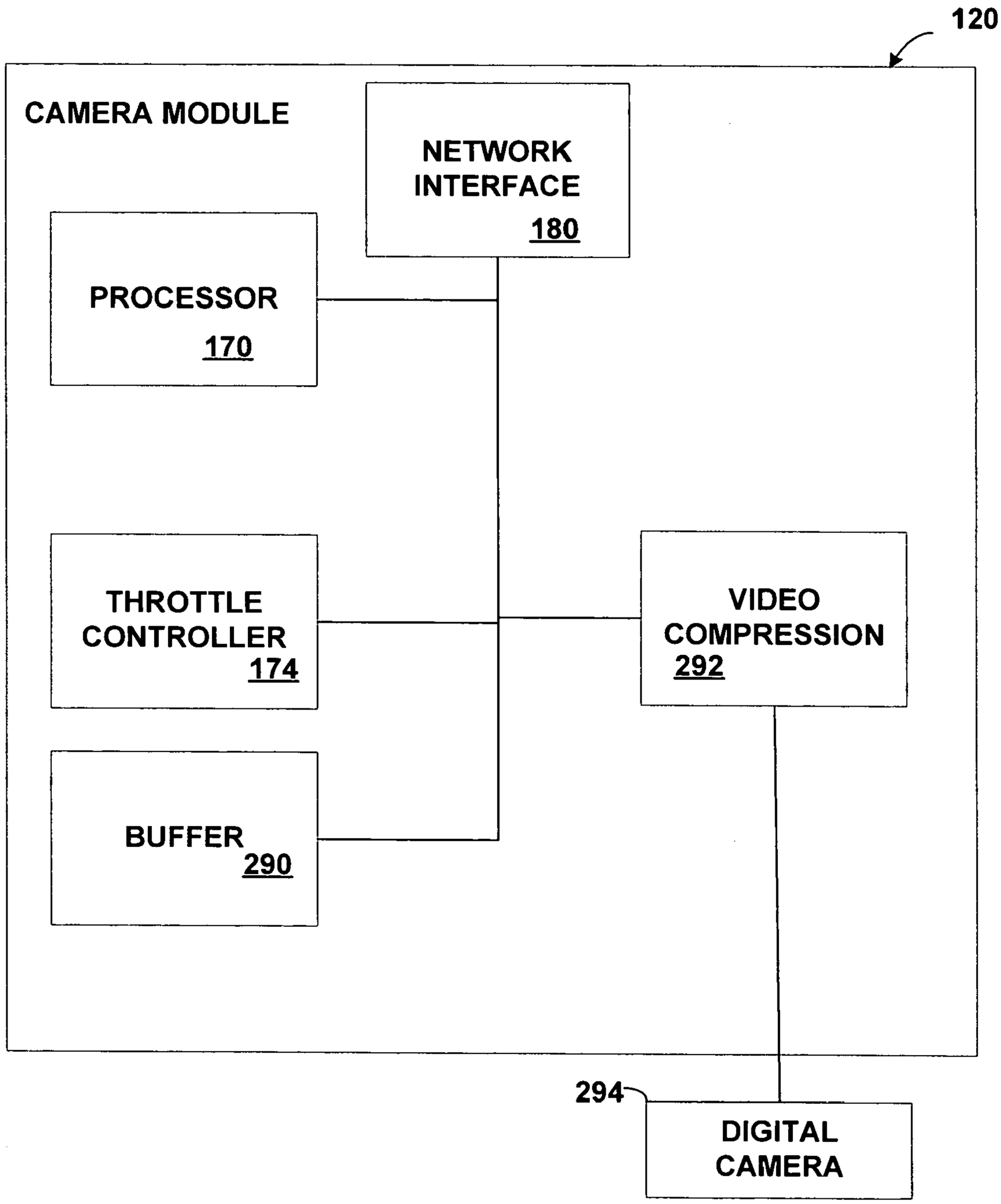

120
CAMERA MODULE
NETWORK INTERFACE
180
PROCESSOR
170
THROTTLE CONTROLLER
174
VIDEO COMPRESSION
292
BUFFER
290
294
DIGITAL CAMERA

FIG. 8

INTEGRATED SECURITY SYSTEM HAVING NETWORK ENABLED ACCESS CONTROL AND INTERFACE DEVICES

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application No. 60/447,544, filed on Feb. 14, 2003 which application is hereby incorporated herein by reference in its entirety.

STATEMENTS REGARDING FEDERALLY SPONSORED RESEARCH

Not applicable.

FIELD OF THE INVENTION

This invention relates generally to security systems and more particularly to security systems including network enabled access control, video and audio devices which communicate over a common local area network.

BACKGROUND OF THE INVENTION

In security applications, separate systems are often needed to provide access control, burglar alarm, and audio and video capabilities at access points in an individual office or a facility including one or more buildings. The installation, the addition of new features and the operation of conventional systems is often complicated by the use of various incompatible communications channels required by the individual systems. Another problem, relating to the addition of new features, is the interoperability of installed legacy systems where hardware replacement is not economically feasible.

Managing the configuration of hardware devices at the lowest levels of the system, for example card readers door switches and motion sensing devices is complicated by the requirement for continued operation during software upgrades and the need to operate with various hardware devices including legacy reader modules, input modules, output modules, and panels (i.e., intelligent devices which control a collection of modules).

FIG. **1** depicts a conventional security system **10** including an access control system **12** having monitoring station **14** coupled via a plurality of dedicated RS-485 lines to a corresponding plurality of security panels **16***a*-**16***n* (generally referred to as panels **16** and also referred to as field devices). The monitoring station **14** is typically a dedicated personal computer running a software application specifically tailored to the system **10**. Each panel **16** is coupled to a plurality of modules **18***a*-**18***n* (also referred to as field devices) via dedicated RS-485 lines. The correspondence between a physical location and each module **18** is determined by a physical wiring connection at installation time. Each module **18** is coupled to a plurality of door controls **20***a*-**20***n* via a plurality of dedicated serial communication (e.g. RS-232, RS-422, RS-485) lines. The system **10** further includes a separate video system **30**. The video monitoring system typically includes a video display **34**, a video mixer **36** (also referred to a video multiplexer **36**) and a plurality of video cameras **38**. The cameras **38**, multiplexer **36** and display **34** are generally coupled via coaxial cable (coax) which is more expensive than the dedicated RS-485 lines used in the access control system **12**. The cameras **38***a*-**38***n* are typically controlled by the video display **34** over control lines **35***a*-**35***n* to provide

pan, tilt and zoom (PTZ) functions. An optional video tape recorder (VCR) (not shown) or digital video recorder (DVR) (not shown) is connected to the mixer **36** to provide a temporary storage of images captured by the cameras **38**. In conventional systems, access control wiring connecting the modules **18** is generally wired back to a central closet where the panels **16** are located.

The monitoring station **14** includes a dedicated software application that communicates with each panel **16***a*-**16***n*. The addition of new user interfaces and remote interaction with the security monitoring application is difficult with the configuration of FIG. **1** because typically a single application operates on the dedicated monitoring station **14**. Expanding the number of door controls **20**, field devices **18** and panels **16** is difficult because of the RS-485 communication protocols and transmission speeds. It is further difficult for the panels **18** to interoperate with devices using newer technology or operating with different communications protocols.

Access systems for larger facilities often supervise numerous access points. In order to effectively supervise door controls coupled to field devices a relatively large number of panels **16** are required. These panels **16** provide a relatively small data bandwidth channel from the monitoring station **14** to devices proximate to the access points. Because of the low data rate, it is not feasible to transmit audio or video data to or through the panels **16**, and therefore it is difficult to integrate video and audio with other data at the access points. It is also difficult to effectively remotely monitor and diagnose device problems and failures at an access point.

The installation of access control, video, and audio devices in conventional systems is complicated by the panel topology and the use of a combination of video cable, and cable wiring which is used to identify a specific device. Other problems associated with point to point wiring include connecting multiple conductors, labeling each of these conductors, and associating each device with a physical location.

Some conventional systems, such as that described in U.S. Pat. No. 6,504,479 attempt to integrate an image based video security system, a burglar alarm system and an access control system to detect the presence of an intrusion onto a site. However, the control, sensor, video, audio, and bi-directional components in these systems do not operate over a common communications channel and are typically integrated through interfaces from each of the separate applications top level management software, rather than through direct interaction between the lower-level components. Control of these systems is directed from a central monitoring center.

It would, therefore, be desirable to provide a security system including distributed control, monitoring, audio and video devices operating over a common communications channel which facilitates the interoperability of the security system with installed legacy panels and associated modules on the common communications channel. It would be further desirable to reduce the number of installation tasks and simplify the security system installation.

SUMMARY OF THE INVENTION

In accordance with the present invention, an integrated security system operating over a network includes a network security controller coupled to the network having a relational database including portal objects and related resources represented in at least one table in the relational database. The system further includes at least one network node having a local database coupled to the network adapted to receive predetermined resource information from the relational database, an event generator coupled to the local database to

provide at least one portal event in response to the predetermined resource information received by the local database, and a finite state portal controller coupled to the network and the event generator for providing at least one of an action and a global event in response to the at least one portal event. With such an arrangement, the interoperability of a security system with installed legacy panels and associated modules on a common communications channel is facilitated by handling access control events from a range of devices in a network node. This arrangement reduces the number of installation tasks and simplifies the security system installation.

In accordance with a further aspect of the invention a method to normalize an access control event includes converting a field device signal representing the access control event to a data stream, normalizing the data stream to provide a portal event, and processing the portal event in a finite state portal controller to provide local actions and global events. With such a technique, legacy security panels including non-networked enabled devices can interoperate with the integrated security system on a common communications channel.

In one embodiment, an extensible markup language, XML, is used to represent predetermined resource information and global events transmitted between the network security controller and the network nodes. In another embodiment, a security system administrative user can access the security system using a standard web browser that operates on a variety of computer platforms. This provides a zero footprint programming model whereby no installed components of software are required on an administrative user's PC. The use of the standard web browser reduces software maintenance, training, support and installation costs since special software is not required for the administrator's computer.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing features of this invention, as well as the invention itself, may be more fully understood from the following description of the drawings in which:

FIG. **1** is a block diagram of a prior art access control system;

FIG. **2** is a schematic block diagram of an integrated security system including network security controllers and network enabled access control, protocol adaptor and interface devices according to the invention;

FIG. **3** is a block diagram of the network security controller of FIG. **2**;

FIG. **4** is a block diagram of a network node similar to the protocol adaptor, access control device and I/O module of FIG. **2**;

FIG. **5** is a block diagram of the protocol adaptor of FIG. **2**;

FIG. **6** is a flow diagram illustrating the steps to normalize the data stream from a legacy field device received by the protocol adaptor of FIG. **4**;

FIG. **7** is a block diagram of the network enabled access control device of FIG. **2**; and

FIG. **8** is a block diagram of the network enabled camera module of FIG. **2**.

DETAILED DESCRIPTION OF THE INVENTION

Before providing a detailed description of the invention, it may be helpful to define some of the terms used in the description. The term "network enabled" as used herein refers to a device (also referred to as a module) or system which communicates over network media using an open system transport and data protocol, for example the TCP/IP protocol over a variety of physical media, including but not limited to CSMA/CD (Carrier Sense Multiple Access LANs with Collision Detection) Ethernet IEEE 802.3, Wi-FI Wireless LAN IEEE 802.11, Wireless Personal Area Network IEEE 802.15, Broadband Wireless Access IEEE 802.16, Broadband, HomePlug® and HomePNA™ networks.

As used herein, the term "portal" also referred to as "access portal" refers to a physical opening or area under access control and/or supervision. A security system permits or denies physical access between the low security (e.g., outside an office) and high security side of the portal. The term "access point" as used herein refers to a location where identification information is acquired and where physical access is controlled (e.g. allowed or prevented). An access point may be associated with card readers, other identification (ID) devices, keypads, and access portals having relays and alarm inputs.

As used herein, a "door switch monitor" (DSM) refers to an input signal to the access point that indicates the secured/unsecured (i.e., closed/open) status of an associated access portal. The term "request-to-exit" (REX) refers to an input signal at an access point that indicates that a person on the secure side of an access portal has been detected. The REX allows the person to exit, and the person can pass through the access portal from the secure side to the unsecured side without causing an alarm.

As used herein, a "finite state machine" (FSM) refers to a process including a set of states, a start state, a set of events, and a transition function that maps events and current states to a next state. A "finite state portal controller" is an FSM arranged to receive portal events and to provide actions and global events in response to the portal events. The actions are referred to as local actions when the actions affect only devices controlled by the finite state portal controller. As used herein, a "portal event" is an event associated with a portal. A first example is a REX activation signal at a portal. A second example is a "Valid Card Read" signal resulting from a validated card read with corresponding card data at an access point associated with a portal. A "global event," as used herein, is an event that is associated with a portal having a global identifier (i.e., a unique identifier associated with the portal or alarm point) and includes, for example, activity logging data from a portal.

As used herein, an "action" also referred to as a "local action" refers to the operation of a component of the security system, for example, unlocking a door lock, setting or resetting a relay, sounding an audible alarm, commanding a camera to move and capture images, and sending an e-mail, text or voice message to a user.

Now referring to FIG. **2**, an exemplary network enabled integrated security system **100** includes a plurality of user PCs **104***a*-**104***m* running a plurality of commercially available browsers **106***a*-**106***m* (generally referred to as browser **106** or web browser **106**), and network printer **108**, each coupled to a company local area network (LAN) **102**. The system **100** further includes one or more network security controllers **110***a*-**110***m* (generally referred to as network security controller **110** and also referred to as network security panel) coupled to the company LAN **102** and a portion of a private LAN **112** (shown at one access point for clarity). It will be appreciated by those of ordinary skill in the art that the company LAN **102** and a portion of the private LAN **112** could be provided by a single physical network, a single network including one or more virtual LANs (VLANs), or network segments coupled by routers, bridges and switches.

An optional protocol adaptor **114** and access control device **122** are coupled to a portion of the private LAN **112** and are

also referred to as network nodes **118***a*, **118***b*, and **118***p* and network enabled devices **118**, respectively and collectively referred to as network nodes **118**. The common components of the network node **118** are described below in conjunction with FIG. **4**. The optional protocol adaptor **114** is coupled to a plurality of legacy field devices **116***a*-**116***j* (generally referred to as legacy field device **116**), and is coupled to the portion of the private LAN **112**. A legacy field device **116** includes but is not limited to a control panel, a reader module, input module, output module, communications modules and biometric devices. Here for example, legacy field device **116***j* is a panel **116***j* (also referred to as a security panel, or a sub-panel) similar to the panel **16***a* (FIG. **1**). The panel **116***j* is coupled to a reader module **130**, an input module **131**, an output module, and a communications module **133** (collectively referred to as modules **130**-**133**). Legacy field devices **116** generally use a protocol which is incompatible with the private LAN **112**.

The network enabled access control device **122** is coupled to a plurality of door controls **124***a*-**124***n* (generally referred to a door control **124**) and a plurality of input output (I/O) extensions **126***a*-**1261** (generally referred to a I/O extension **126**). The access control device **122** generally controls several door controls **124** and I/O extensions **126** which provide resources to several portals. The door control **124** (also referred to as access extension **124**) generally includes two reader interfaces (not shown), at least one lock relay (not shown) that operates a door strike (not shown) and other devices (e.g. an LED or an indicator lamp), a DSM input (not shown) and a REX input (not shown). It is understood, that a various configurations of readers, supervised inputs (inputs monitored by the access control device **122**), DSM and REX inputs, and control relays can be provided at the access extension **124** as resources related to a portal. The access control device **122** may use biometric identification and may include a pair of readers (not shown) on each side of the access portal. The I/O extension **126**, which is similar to access extension **124**, includes different combinations of input ports and output ports and generally does not include reader interfaces.

A network enabled video camera module **120** (also referred to as a IP camera module **120** or an network enabled interface) coupled to at least one camera **121**, is coupled to the portion of the private LAN **112**. A network enabled intercom module **128** (also referred to as an intercom **128** or a network enabled interface) is coupled to the portion of the private LAN **112**.

The private LAN **112** is a packet network and the physical implementation includes but is not limited to Ethernet type wiring (e.g., 10/100/1000 BaseT), HomePlug® or HomePNA™ network (i.e. communication over power lines or phone wiring), fiber, and wireless communication. It will be appreciated by those of ordinary skill in the art that the company LAN **102** and the private LAN **112** can each optionally include additional segments interconnected by routers, bridges, firewalls and other communications devices and each LAN **102**, **112** can be connected to the Internet and that the company LAN **102** can include the private LAN **112**, and the system **100** can operated over a single LAN.

In operation, the network security controller **110** provides a web server accessible to one or more administrative users using the browsers **106***a*-**106***m*. It is understood that multiple users can access the web server from the multiple browsers **106***a*-**106***m*, and that security can be provided by various means including but not limited to biometric identification, secure socket layer (SSL), virtual LANs, virtual private networks (VPN) and secure web server protocols HTTPS. The basic functions of access control at each portal are provided by the resources coupled to the access control device **122** in conjunction with one or more network security controllers **110**. In one embodiment, in an access scenario, a person seeking access presents a credential including but not limited to a proximity card (PROX), a magnetic-stripe card, a smart card (with biometric identification data or digital certificates) and a Wiegand ID card, at the card reader coupled to a reader interface on an access extension **124** coupled to the access control device **122**. The reader transmits the person's card ID number to the access extension **124**. The access extension **124** transmits the card ID number to the access control device **122**. The access control device **122** then compares the card ID number valid card numbers in a local database to see if that person associated with the card ID number has permission to pass through the portal at the current time. If the person has permission to enter, the access control device **122** provides a portal event "Valid Card Read," a local action actuates the door control **124** to unlock the door, and a global event Valid Access including the global identifier for the portal and the card data is for the portal and the card data is sent to the network security controller **110**. In this embodiment, the network security controller **110** will act as a master database and keeps the local databases on the access control devices **122** up to date and synchronized. Additionally, the access control device **122** can query the database on the network security controller **110** before rejecting the person's access card. In an alternative embodiment, the card database will be stored in a database on the network security controller **110**, which makes the decision to allow access and sends the decision back to the access control device **122**.

The access extension **124** and the I/O extension **126** support supervised inputs, contact closures, and contacts having end of line termination in order to report state changes of inputs. The access extension **124** and the I/O extension **126** support outputs (e.g., relays) and receive commands to change the output state. For example, a DSM (door monitor) senses the open/secured state of the door and the REX (request-to-exit) point is used to signal that the door will be opened from the secure side without a card read. The access extension **124** and the I/O extension **126** support programmable logic control (PLC) controls locally, so that outputs may be configured to follow inputs under certain circumstances, and relays can have locally timed activations. The access point can, itself, include supervised inputs and outputs. The access extension **124** and the I/O extension **126** in conjunction with the access control device **122** support input suppression so that not all state changes are processed to provide portal events. The access extension **124** further supports reader interfaces including but not limited to Wiegand readers, magnetic-stripe readers, pin pads, and smart cards. In one embodiment, the access control device **122** is coupled to a combination of access extension **124** and the I/O extension **126** which matches the resources of the portals to be controlled.

During installation, the network nodes **118** (i.e., the protocol adaptor **114** and the access control device **122**), the camera module **120** and the intercom **128** (collectively referred to as network enabled devices) include electronic identification (e.g. a physical hardware interface address or MAC address determined by known address resolution protocol techniques). After installation, a physical location is associated with each identified network enabled device by various means including the use of a wireless browser, a PDA, and specially coded access cards. For example, the installer in the process of verifying the operation of system **100** can access a program on the web server that selects a predetermined location and directs the installer to operate a card reader associ-

ated with a predetermined door control **124**. Alternatively the installer can select a location and proceed to identify the devices. Likewise the location of a camera **121** or intercom **128** can be determined by the use of the browser and actions of the installer (e.g. pressing the intercom **128** push to talk button or placing a pattern card in front of the camera **121**). Installation time is further reduced because wiring from each network enabled devices is connected to nearby LAN **112** connections and not back to a central closet location.

The camera module **120** provides compressed video over the private LAN **112** therefore there is no requirement for analog mixing or multiplexing of video signal and no requirement for coaxial cable wiring. Multiple displays and camera sequencing are controlled in software in the network security controller **110**. If required, the camera module supports pan, tilt and zoom (PTZ) operations by requests over the LAN from an operator (e.g. a security guard monitoring the facility), or automatically by software running in the network security controller **110** or the camera module **120** to track and follow activity. The intercom **128** provides a full duplex voice path using audio compression techniques and sending the resulting packetized data over the LAN using voice over IP (VoIP) or other methods known in the art.

In one embodiment, as described below in more detail in conjunction with FIG. **3**, the network traffic to and from the network enabled devices and the network security controller **110** are monitored, such that the latency of the transmission of global events from the network nodes **118** to the network security controller **110** does not exceed a predetermined time interval. If necessary, the data transmission to and from the high data rate network enabled devices (e.g., the camera module **120** and the intercom **128**) are throttled back to maintain the required minimum latency which affect the effective supervised update rate of the resources at each access point. To prevent loss of data in this case, high data rate devices have local buffering of data sources so that important information such as video data, is not lost even when the data transfer rate throttled back.

The network enabled devices can be coupled to the private LAN **112** using CAT5E or CAT6 wiring, a HomePlug® interface, or any other interface which supports a TCP/IP protocol. The network security controller **110** performs dynamic host configuration protocol (DHCP) functions when this service is not available on the company LAN **102**.

Now referring to FIG. **3** in which like reference numbers indicate like elements of FIG. **2**, an exemplary network security controller **110** includes a firewall **148** coupled to the company LAN **102**. A web server **142**, a throttle controller **136**, a database **1.46**, a logger **150**, an XML parser/generator **152**, an network node controller **154** and an alarm manager **156**, a camera controller **138**, a throttle controller **136** and modem (not shown) are each coupled to the company LAN **102** through the firewall **148** and also coupled to the private LAN **112**. It will be appreciated by those of ordinary skill in the art that not all of these components are required in each application. The blocks denoted "processor," "servers," "controller," "normalizer," "database," "logger," "engine," and "dialer" can represent computer software instructions or groups of instructions. Such processing maybe performed by a single processing apparatus which may, for example, be provided as part of network security controller **110**. Alternatively, the blocks represent steps performed by functionally equivalent circuits such as a digital signal processor circuit or an application specific integrated circuit (ASIC).

The database **146**, in one embodiment is a MySQL™ database and includes a portal table **147** and a resource table **149**. The portal table **147** includes fields related to a portal object, for example, portal identification and portal resources (e.g., reader interfaces, inputs and outputs). In this embodiment, the web server is a 142 GoAhead® web server running both the hyper text transfer protocol (HTTP) and the secure hyper text transfer protocol (HTTPS) protocols.

In operation, the optional firewall **148** provides security by blocking unauthorized access to the private LAN **112**. An optional SNMP processor (not shown) can be used to process and send SMMP messages for diagnostic purposes. The network security controller **110** provides administration and application support through an embedded web server **142** coupled to the web browsers **106***a*-**106***m* on the company LAN **102** and the private LAN **112** and serves as a point of integration for the plurality of network enabled devices. In object oriented software terms, the network security controller **110** acts as a container object for a plurality of objects that, when properly coordinated, provide the core functionality of one or more security applications. The network security controller **110** operates either as networked device that can interact with other devices and computers on the company LAN **102**, and in one embodiment is a microprocessor controlled embedded server. As a stand-alone device, the only external access is through a web browser **106** that interacts with the network security controller's internal web server **142**. Data can be archived off of and reloaded on to the network security controller **110** using the network security controller's **110** internal file transport protocol (FTP) server or other secure means coupled to network attached storage (not shown).

The network security controller **110** handles several high level support and management functions. The web server **142** supports web access via HTTP and HTTPS protocols to provide an administrative user interface for access through the web browser **106** and supports FTP for making offline backups. The web server **142** also provides access to logged data, notification of alarms, ability to manage the system (e.g. add, delete or modify user access permissions) and so forth. The optional firewall **148** separates the company LAN from the private LAN **112** for the purposes of security and bandwidth isolation. The database **146** provides database functionality for portal objects and resources and other functions (e.g. ID card database for access control) and supplies predetermined resource information to network nodes **118**. The database **146** updates and synchronizes the resource information in one or more network nodes **118** in conjunction with the network node controller **154**.

The logger **150** maintains a log of global events associated with portals under control by network nodes **118** couple to the network security controller **110**; The logger **150** keeps a history or data log of all activity at any of the network enabled devices controlled by the network security controller **110**. This includes time stamped access requests, door alarms, and information from network nodes **118** and attached resources. This information can be viewed by the browsers **106***a*-**106***m* or downloaded to another system or network attached storage.

The alarm manager **156** supervises a the portals and associated resources and handles point associations across multiple access extensions **124** (door controls **124**), I/O extensions **126** and legacy modules **130-133** to provide alarm monitoring and supervision. For example, an output on one I/O extension **126***a* can follow (i.e., turn off and on as a result of the state) an input on I/O extension **1261**. The network node controller **154** serves as a point of configuration management for the plurality of network nodes **118**. In one embodiment, the network node controller **154** provides diagnostics and heartbeats for monitoring the health of the com-

munications paths between the network security controller **110** and the network nodes **118**.

The network security controller **110** also supports the integration of specific applications, including but not limited to: higher level access control functions like anti-passback, and handles known advanced access control regimes like the two-man rule and escorted access; elevator access control enabled floor buttons through relay closures; parking control, region counts by card type, parking "lot full", etc. indicators; and video.

The throttle controller **136** in conjunction with throttle controllers on the network enabled devices (e.g., the camera module **120**), provides control of the network data stream from the camera module buffer such that the response of the door control supervision and the polling frequency of supervised inputs meets the operational requirements. The XML parser/generator **152** supports the representation of the predetermined resource information and global events in an extensible markup language. In one embodiment, the XML parser/generator **152** includes a Unicoi Systems Inc. Fusion Embedded XML DOM parser.

In one embodiment, the web server **142**, the network node controller **154** and the alarm manager **156** are coupled by an interprocess communications mechanism, for example shared memory (not shown). The network node controller **154** and the web server **142** are coupled to the database **146** using an applications programming interface (API).

It will be appreciated by those of ordinary skill in the art that security for data transmissions on the company LAN **102** and the private LAN **112** can be provided by encryption and decryption techniques and the use of secure sockets SSL and IPSEC protocols as are known in the art. Encrypting the data, for example using 128-bit (or higher level) encryption, secures data exposed on the entire network (company LAN **102** or private LAN **112**). Encryption of video, audio, access or I/O data at the module level provides protection from unauthorized intrusion or snooping. The network nodes **118** optionally include a self-diagnostic module to assure that everything is working properly within the network node **118** and if necessary reporting the status to the network security controller **110**.

Now referring to FIG. **4**, an exemplary network node **118** similar to the protocol adaptor **114** and the access control device **122** of FIG. **2**, includes a finite state portal controller **162** and a local database **176** coupled to a network. The network node **118** further includes an event generator **163** coupled to the finite state portal controller **162** and the local database **176**. In one embodiment, a similar event generator **163'** operates in the protocol adaptor **114** of FIG. **2** as described in mere detail in conjunction with FIGS. **5** and **6**. In another embodiment, a similar event generator **163"** operates in the access control device **122** as described in more detail in conjunction with FIG. **7**.

The event generator **163** processes data from external resources and uses predetermined resource information stored in the local database **176** to generate portal events which are subsequently processed by the finite state portal controller **162**. Resource information generally includes the resource type (e.g., reader, input, output, and temperature), the location of the resource, the association with a portal, and the usage of the resource. For example, an input can be used as a REX, a DSM or an alarm input. In one embodiment, the resource information is stored in at least one table in the database **146** and downloaded as an XML message to the network node **118** local database **176**. The local database **176** facilitates the mapping of a signal having one of a plurality of states from a physical device or module location into a portal event. An input resource can have one of four states, for example: NORMAL, ALARM, OPEN, SHORT, corresponding to voltages measured on the signal line. It will be appreciated by those of ordinary skill in the art that a signal can have fewer or more than four states. The local database **176** may also include access card information to provide portal events in conjunction with access reader identification signals. The reader identification signals include but are not limited to Wiegand card data, smart card data, keypad data and biometric data (e.g. fingerprints and facial images).

In one embodiment the local database **176** includes arrays in local storage which map signal and associated states into portal events including a local portal identifier. The local database **176** further includes a mapping from local portal identifier to global portal identifiers to provide generation of global events by the finite state portal controller **162**. The local database **176** provides a mapping from a local portal identifier to a physical device or module location to facilitate local actions from the finite state portal controller **162**, for example, activating a lock strike to lock or unlock a door.

The network node **118** communicates with the network node controller **154** (FIG. **3**) located in the network security controller **110**. The network node controller **154** performs queries on database **146** (FIG. **3**) to provide configuration data to the local database **176**. The predetermined resource information includes configuration information related to each of a plurality of portal objects stored in the database **146**.

Now referring to FIG. **5** in which like reference numbers indicate like elements of FIGS. **2** and **4**, the exemplary protocol adaptor **114** includes a network interface **160** coupled to an XML parser/generator **152'** (similar to the XML parser/generator **152** of FIG. **3**), the finite state portal controller **162**, the local database **176**, and an event generator **163'** (similar to the event generator **163** of FIG. **4**). The event generator **163'** includes a protocol normalizer **164** coupled to the finite state portal controller **162** and the local database **176**, a data stream converter **166** which is coupled to the protocol normalizer **164** and to a signal interface **168** adapted to receive data signals from at least one legacy field device **116**.

In one embodiment, the signal interface **168** is an RS-485 interface. It will be appreciated by those of ordinary skill in the art that an alternative serial interface, for example, RS-232, RS-422 or network interface can be substituted for the RS-485 interface. The RS-485 interface is coupled to the legacy field device **116**. The operation of the protocol adaptor **114** is described further in conjunction with FIG. **6**. The signal interface **168**, in one embodiment, is a asynchronous receiver transmitter (UART) using an RS-485 multi-drop protocol, communicates with a plurality of legacy field devices **116**, each legacy field device **116***a*-**116***j* having a unique address. The data stream converter **166** processes an access control event **175** from the legacy field devices **116**, calculates and checks the CRC for some legacy field devices **116**. Some legacy field devices **116** require a polling sequence which is generated by the data stream converter **166**. A local action is processed by the data stream converter **166** resulting in a local action field device signal **177** being transmitted to the legacy field device **116**.

The protocol normalizer **164** processes the converted data stream using a mapping function in conjunction with the local database **176**. The mapping function processes state changes and detects state changes. The state changes are transformed into portal events which are subsequently processed by the finite state portal controller **162**. The legacy field device **116** can be one of modules **130**-**133**-(FIG. **2**) or a panel coupled to at least one of modules **130**-**133**. If the legacy field device **116** is a panel, data from the local database **176** is downloaded into

the panel. Although the panel directly controls the portals coupled to the panel, the control of the devices is replicated in the finite state portal controller **162** thereby providing a normalized view of the portal objects including current state information to the network security controller **110**. Here, the finite state portal controller **162** does not execute actions which control hardware such as door locks because the legacy field devices **116** (i.e. a panel) is actually controlling the door lock. In one embodiment, including panels as legacy field devices **116**, some control over portal is delegated to the panel, but the state of the portal and associated resources is replicated by the finite state portal controller **162** in the protocol adaptor **114**.

Turning now to FIG. **6** in which like reference numbers refer to like elements of FIGS. **2**, **3**, and **5**, a flow diagram illustrates a process for normalizing access control events received by the protocol adaptor **114** of FIG. **5**. Protocol normalization is a process by which legacy field devices **116** are made accessible to the integrated security system **100** for one or more of the integrated security applications (e.g. access control). The protocol normalization process maps input data streams and between the protocol adaptor **114** and the legacy field devices **116** into portal events and signals to control legacy field devices **116**. The protocol normalization process also maps commands from the network security controller **110** into signals to control legacy field devices **116** resources at a portal. In one embodiment, an extensible markup language (XML) is used for representing the predetermined resource information and global events transmitted between the protocol adaptor **114** and the network security controller **110**. In one embodiment, an object-oriented paradigm based on portal and resource tables in a relational database is used by the network security controller **110** to model the field devices, access portals and access points.

In the flow diagram of FIG. **6** the rectangular elements are herein denoted "processing blocks" (typified by element **202** in FIG. **6**) and represent computer software instructions or groups of instructions. The diamond shaped elements in the flow diagrams are herein denoted "decision blocks" (typified by element **212** in FIG. **6**) and represent computer software instructions or groups of instructions which affect the operation of the processing blocks, Alternatively, the processing blocks represent steps performed by functionally equivalent circuits such as a digital signal processor circuit or an application specific integrated circuit (ASIC). It will be appreciated by those of ordinary skill in the art that some of the steps described in the flow diagrams may be implemented via computer software while others may be implemented in a different manner (e.g. via an empirical procedure). The flow diagrams do not depict the syntax of any particular programming language. Rather, the flow diagrams illustrate the functional information used to generate computer software to perform the required processing. It should be noted that many routine program elements, such as initialization of loops and variables and the use of temporary variables, are not shown. It will be appreciated by those of ordinary skill in the art that unless otherwise indicated herein, the particular sequence of steps described is illustrative only and can be varied without departing from the spirit of the invention.

The process commences in step **200**. In step **202**, predetermined resource information is downloaded from the network security controller **110** and stored into the local database **176** of the protocol adaptor **114**. In one embodiment, the predetermined resource information is configuration data generally derived from a portal table and a resource table in the relational database on the network security controller **110**. In this embodiment, the resource information results from SQL queries associating portal objects with portal resources. Here, the relational database is a MySQL™ running on an embedded Linux® operating system. In this embodiment, the configuration data is downloaded over a TCP/IP socket in an extensible markup language representation, for example XML. An XML representation provides portability, efficient upgrades, and flexibility in an enterprise wide system deployment. The TCP/IP sockets are authenticated using hardware tokens including secure hash algorithms and portions of the XML data is encrypted using small message encryption techniques known in the art. In this embodiment the network security controller **110** executes a query including the particular protocol adaptor **114** resources to limit the amount of data downloaded to local database **176**. Portal object characteristics, description and XML representation associated with a portal in this embodiment, include:

Characteristic	Description	XML tag
Name	Text portal name	NAME
ID	ID assigned to the portal	ID
Reader resource	Wiegand or magnetic stripe	TYPE
REX resource	Input point id for REX point	REX
DSM point	Input point id for DSM	DSM
Lock point	Output used for lock control	LOCK

In this embodiment, portal objects are represented in a Portal table in the database **146**. The Portal table includes the following fields: ID; reader**1**ResourceID; reader**2**ResourceID; dsmResourceID; rexResourceID; lockResourceID; and name.

The resource information is represented in a Resource table in the database **146**. The Resource table includes the following fields: ID; NetworkNodeID; Name; Description; Disabled flag; TypeCode; Panel Address; Slot; and Position. It is understood that the portal object and resource information can be represented in one or more tables and in tables with different names and fields. To further uniquely identify a resource on a system with multiple network security controllers **110**, each with its own complement of network nodes **118**, the network security controller's **110** name is added to the address:

<network security controller>.<node name>.<panel>.<type>.<slot>.<position>.

The network node controller **154** in conjunction with the XML parser/generator **152** generates the following exemplary XML for a two-reader portal connected to a legacy panel having address **2**:

```
<S2NN ID="0FCA56B5" NAME="DownstairsNode">
<PORTAL NAME="Front door" ID="1">
  <DSM SHUNT_TIME="12"
    RELOCK="TRUE">P.2.I.5.1</DSM>
  <REX UNLOCK_ON_REX="FALSE">P.2.I.5.2</
    REX>
  <LOCK LOCK_TIME="10">P.2.O.5.1</LOCK>
<READER TYPE="WIEGAND">P.2.R.5.2</READER>
</PORTAL>
</S2NN>
```

In this example a legacy field device signal (e.g. REX) is mapped to P2.1.5.2. After receiving this XML document, the XML is parsed by XML parser/generator **152'** and the predetermined resource information is stored in local database **176**, and processing continues in step **204**.

In step **204**, a field device signal resulting from the access control event **175** is converted to a data stream by the signal

interface **168**. Depending on the legacy field device **116**, a cyclic redundancy check (CRC) or checksum check is performed and the signal is decomposed into structured data by the data stream converter **166**. In the above example a legacy field device signal (e.g. REX) is generated at input port **2** on input module **5** which is connected to panel **2** and associated with the portal "Front Door" when the REX input transitions from state NORMAL to ALARM.

In step **206**, the structured data is processed into state changes and reader events associated with a portal in the local database. Some legacy field devices **116** report the state of each resource and the data stream converter **166** maintains a state table for each resource in order to detect state changes. For some legacy field devices **116** commands are issued to the legacy field devices **116** to get the status of a resource. Other legacy field devices **116** provide a data stream which is translated into state changes and reader information using lookup tables or similar methods known in the art. In step **206**, protocol normalizer **164** normalizes state changes and reader data into to portal events using the predetermined resource information stored in the local database **176**. Using the predetermined resource information, the protocol normalizer **164** maps the location of the access control event **175** to determine the associated portal, the type of resource, and whether the resource is coupled to a panel. Finally the protocol normalizer **164** maps the state of the access control event **175**, in the case of an input module, into a portal event. If the resource is a reader interface, the protocol normalizer **164** validates the ID card data and maps the result and the data into a portal event. The portal event is queued to the finite state portal controller **162** and processing continues in step **208**. In the above example, a legacy field device signal (e.g. REX) is mapped from P2. 1.5.2, state ALARM into the portal event, REX_Activation at the "Front Door," and the portal event is queued to the finite state portal controller **162**.

In step **208**, the portal event is processed by the finite state portal controller **162**, and a state transition may occur as a function of the portal event and the current state of the portal. In one embodiment, portal events associated with REX and DSM signals include: Door Open; Door Closed; REX Activation; and REX Deactivation. Portal events associated with readers include: Invalid Card Read; and "Valid Card Read." Examples of Portal States in conjunction with the finite state portal controller **162** include: Portal Ready; Door Forced; and Door Held.

In step **210**, depending on the state transition a global event may be generated. Global events are generated, for example, when a door is forced open. In one embodiment the global events are queued in a circular log buffer on the protocol adaptor **114**.

In step **212**, it is determined whether the field device is a module (and not a panel). If it is determined than the field device is a module any local actions generated by the state transition in the finite state portal controller **162** at step **208**, are processed in step **214**, otherwise processing continues in step **216**. In the above example, since the legacy field device signal is mapped to a panel P**2** no local action is process because the panel takes the appropriate action, here, to unlock the portal door in response to the REX signal.

In step **214**, the local action, for example, an action to unlock a door, is processed in response to the portal event. Examples of local actions initiated by the finite state portal controller **162** include: Activate_Portal_Relay; Log_Activate_Portal_Relay; Door_Held_Actions; report_REX_open; and Relock_Portal. The door open action is subsequently converted to a local action field device signal **177** using the predetermined resource information and transmitted to the field device **116** by the data stream converter **166** and the signal interface **168**, in step **216**.

In step **218**, the global event is transmitted to the network security controller **110**. Global events include data log information flowing from the protocol adaptor **114** to the network security controller **110**. In one embodiment, global event log messages are represented in XML having the general form:

<LOG TYPE="nn" TIME="ttttt"> . . . log contents . . . <LOG>

where "nn" is the log type number; and

"ttttt" is the clock time expressed elapsed since Jan. 1, 1970.

The protocol adaptor **114** encodes the data log into XML, maintaining a loose coupling between the protocol adaptor **114** and the associated network security controller **110**. Thus, the network security controller **110** can operate without concern for a particular version of the protocol adaptor **114** firmware. The global event packets are received, parsed by the XML parser/generator **152**, and logged by the logger **150** (FIG. **3**). Examples of global events and the corresponding XML are listed below:

Type	Description	Parameter(s)	Example
1	Valid access completed	Access card number	<LOG TYPE="1" TIME="1234" > <CARDNO>12345</CARDNO>
		Portal ID	<PORTAL>1</PORTAL>
		Reader ID	<READER>2</READER> </LOG>
2	Invalid access attempt	Access card number	<LOG TYPE="2" TIME="1234" > <CARDNO>12345</CARDNO>
		Portal ID	<PORTAL>1</PORTAL>
		Reader ID	<READER>2</READER>
		Reason code	<REASON>1</REASON> </LOG>
3	Door held open	Portal ID	<LOG TYPE="3" TIME="1234" > <PORTAL>1</PORTAL> </LOG>
4	Door forced open	Portal ID	<LOG TYPE="4" TIME="1234" > <PORTAL>1</PORTAL> </LOG>

On the protocol adaptor **114** processing resumes in step **204**, where additional access control events are processed. On the network security controller **110** processing continues in step **220**.

Steps **220**, **222** and **224** occur on the network security controller **110**. In step **220**, the global event is logged in the database **146** and the alarm manager **156** processes the global event if necessary. In step **222** it is determined whether a response to a global event is required. If a response is required, processing continues in step **224**, otherwise processing of this global event terminates in step **232**. In step **224**, a command is sent to the protocol adaptor **114**. The command could be sent in response to a global event or asynchronously sent as a user command from the browser **106**.

In step **226** the command is received by the protocol adaptor **114**. In step **228**, the command is processed by the protocol normalizer **164** using the local database **176** predetermined resource information to determine the portal and resource associated with the command. In step **230**, a portal event is generated. In one embodiment, the command is represented in XML and is parsed to provide the portal event. Processing of the portal event from the command continues in step **212**.

Now referring to FIG. **7** in which like reference numbers indicate like elements of FIGS. **2** and **4**, an exemplary network enabled access control device **122** (also referred to as a network node **118**) includes a network interface **180** coupled to the finite state portal controller **162**. The finite state portal controller **162** is coupled to the XML parser/generator **152'**, the local database **176**, a supervision controller **182**, and an I/O controller **184**. The I/O controller **184** is coupled to a combination of access extensions **190** (one extension of each type shown for clarity), input extensions **192**, output extensions **194**, and temperature extensions **196** (collectively referred to as extensions). The exact combination of extensions depends on a specific portal configuration and system requirements. In one embodiment, the access extensions **124**, I/O extension, and temperature extensions operate on an industry standard 1^2C bus coupled to the access control device **122**.

The access control device **122** operates in a manner similar to the protocol adaptor **114** described in FIGS. **5** and **6**. The operation is simplified because there are no intermediate panels therefore step **212** is not required. The operation is further simplified because the resources all have a uniform slot and position addressing topology. The supervision controller **182**, and the I/O controller **184** form an event generator **163"** similar to the event generator **163** (FIG. **4**) to generate portal events. The I/O controller **184** provides a polling loop to detect state changes on the extensions, handles reader input from the access extension **190**, and communicates with the temperature extension **196** to measure temperature and set temperature alarms. The supervision controller **182** provides the mapping function in conjunction with the local database **176** predetermined resource information, to map access control and temperature events from the extensions **190-196** into portal events. In one embodiment, the local database **176** is the primary source for user, card and configuration information, and is implemented in flash memory which is nonvolatile and is not erased if power to the access control device **122** is interrupted. Alternatively, battery backed SRAM or EEPROM is used for this purpose.

The access extension **190** provides a means of user identification (not shown) coupled to I/O controller **184** including but not limited to a numeric keypad, a keypad with an associated reader and a biometric device, and supports various card and other access control protocols such as a Wiegand communications protocol or a magnetic stripe reader "clock and data" protocol. Biometric access control is provided, for example, by fingerprint or other biometric signature validation. The numeric keypad is used for PIN and other data entry.

An annunciator (not shown) including an alphanumeric display for status and command information provides an indication of when the access extension **190** is idle, and can also display the following data items: date, time, name of the door and user-defined messages. When an access attempt is denied, the display typically displays a message such as "access denied" and optionally also a reason indicator.

Resources coupled to extensions **190-196** perform input and output operations at the hardware level. Resources and corresponding XML type include:

Reader	"R";
Supervised input	"I";
Output	"0"; and
Temperature sensor	"T."

A resource coupled to the access control device **122** can be specified in a dot notation in the XML representation as follows: <node name>.<type>.<slot>.<position> where <node name> is the name associated with the access control device **122**; <type> is the XML type code associated with the primitive; <slot> is a slot position on the 1^2C bus of the node in the range {1.7}; and <position> is the position within the application extension.

To further uniquely identify a resource on a system with multiple network security controllers **110**, each with its own complement of protocol adaptors **114** and access control devices **122**, the network security controllers **110** name is added to the address: <network controller>.<node name>.<type>.<slot>.<position>

For example: MainBranch.FirstFloor.R.5. 1 indicates that the network security controller's **110** name is MainBranch and the security controllers **110** controls the access control device **122** FirstFloor. Extending the example, the access control application extension **190** in slot **5** of the access control device **122**, has the following resources:

Resource	Identifiers
Readers	R.5.1 and R.5.2
Inputs	1.5.1 through R.5.4
Outputs	0.5.1 through 0.5.4

The access extension **190** can also provide a programmable local audible indication of keypad presses. A beep or similar positive acknowledgement of keypad presses is often desirable. The same annunciator may be used to signal door held/forced open or similar alarm conditions. In another embodiment, commands to and from the readers coupled to the access extensions **190** are encrypted to provide additional security. To keep all communication between the access control device **122** and the rest of the system **100** secure, data can be authenticated and encrypted using hardware tokens so that no clear text including commands, ID numbers or biometric data is ever sent on the private LAN **112**. Not only does this protect this data, it also makes it difficult to subvert the activity on the LAN **112** by a malicious person. In this embodiment, 128 bit encryption (or higher) secures data transmitted over the company LAN **102** using SSL.

Now referring to FIG. **8** in which like reference numbers indicate like elements of FIGS. **2** and **7**, an exemplary net-

work enabled video camera module **120** includes at least one digital camera **294** (similar to the digital camera **121** of FIG. **2**) having a PTZ control (not shown), and a processor **170**. The processor **170** is coupled to a throttle controller **174**, a video compression engine **292** (also referred to a video compression processor **292**, and a local memory storage buffer **290** for storing compressed video data. The video camera module **120** adds video functionality to the system **100** and operates in certain situations under the control of the network security controller **110** and autonomously in other situations. Integrated functions, such as video on alarm and snapshot on access are generally controlled by the network security controller **110**.

It will be appreciated by those of ordinary skill in the art that the video camera module **120** and the digital cameras **294** can be combined into a single integrated package, and that the camera module **120** can be connected to more than one digital camera **294**. The digital camera **294** includes but is not limited to a CMOS camera, an image sensor, a CCTV camera, and a video camera. The throttle controller **174** is used in conjunction with the throttle controller **136** (FIG. **3**) in the network security controller **110** to control the data rate from the video camera module **120** such that the supervision of the access point is not detrimentally affected.

In one embodiment, the video camera module **120** operates in one of four modes: Command mode, when the video camera module **120** responds to commands from the network security controller **110**. In preimage mode, the video camera module **120** captures video optimized for memory consumption and stores the video in a circular buffer, overwriting the oldest images with new images. This optimization includes some combination of capture of reduced resolution images, reduced frame rate, or reduced color depth. In preimage mode, the video camera module **120** captures video at a reduced resolution, frame rate, or color depth. Preimage video is typically discarded until an event occurs, at which point the video module enters postimage mode. In postimage mode, the video camera module **120** captures video optimized for detail and use as evidence, writing into the circular image buffer. In postimage mode, the video camera module **120** captures video at an increased resolution and frame rate. In streaming mode, the video camera module **120** passes video to the network security controller **110** as a stream suitable for viewing in real time.

Other optional capabilities of the video camera module **120** include the ability to capture a single frame, capture a video clip for a preset time, number or frames, or until a command to stop capture is received. The video camera module **120** is controlled by the network security controller include to capture a single frame image on an access event in which physical access is granted or denied. When an alarm event occurs, the network security controller **110** directs the video camera module **120** to enter the postimage mode, capturing video for a preset number of frames, time, or until a command to stop is received. Because the camera module **120** is a network enabled device, an alarm event at the network enabled access control device **122** can trigger one of the image modes without the intervention of the network security controller **110**. Zones can be set within the video frame to trigger alarms/events on other network enabled devices by detecting motion within predetermined zones, while ignoring motion outside the predetermined zone. In one embodiment, the camera module **120** is a resource of one or more portals in the camera **294** field of view. A motion detected alarm is sent as an XML document to the supervision controller **182**, parsed by XML parser/generator **152** and mapped into portal events, for example, Video_Motion_Activation, for the affected portals.

All publications and references cited herein are expressly incorporated herein by reference in their entirety.

Having described the preferred embodiments of the invention, it will now become apparent to one of ordinary skill in the art that other embodiments incorporating their concepts may be used. It is felt therefore that these embodiments should not be limited to disclosed embodiments but rather should be limited only by the spirit and scope of the appended claims.

What is claimed is:

1. An integrated security system operating over a network comprising:

a network security controller coupled to the network comprising:

a relational database including portal objects and related resources represented in at least one table in the relational database; at least one network node comprising:

a local database coupled to the network adapted to receive predetermined resource information from the relational database;

an event generator coupled to the local database to provide at least one portal event in response to the predetermined resource information received by the local database, the event generator further comprises a protocol normalizer and a data stream converter coupled to the protocol normalizer and adapted to receive data from a field device; and

a finite state portal controller coupled to the network and the event generator for providing at least one of an action and a global event in response to the at least one portal event.

2. The system of claim **1** wherein the field device is at least one of:

a reader module;

an input module;

an output module;

a communications module and

a panel.

3. The system of claim **1** wherein the event generator comprises:

a supervision controller;

an I/O controller coupled to the supervision controller and adapted to receive signals from at least one of:

an input extension;

an output extension;

a temperature extension; and

an access extension.

4. The system of claim **1** further comprising a network node controller coupled to the database and coupled to the at least one network node.

5. The system of claim **1** wherein the network security controller further comprises an extensible markup language generator and the at least one network node local database downloads an extensible markup language representation of the predetermined resource information.

6. The system of claim **5** wherein the extensible markup language representation comprises XML.

7. The system of claim **1** wherein the at least one global event is represented using an extensible markup language representation.

8. The system of claim **7** wherein the extensible markup language representation comprises XML.

9. The system of claim **1** wherein the network security controller further comprises a web server coupled to the network and the database to provide at least one user interface to the integrated security system in at least one browser.

* * * * *